

Bay Area Air Quality Management District
939 Ellis Street - San Francisco, California 94109

ADVISORY COUNCIL
TECHNICAL COMMITTEE MEETING
9:30 a.m., Tuesday, February 4, 2003
4th Floor Conference Room

Rob Harley, Ph.D., Chairperson, Sam Altshuler, P.E., William Hanna,
Stan Hayes, Norman Lapera, Robert F. Sawyer, P.E., Ph.D.

AGENDA

1. Call to Order – Roll Call

2. Public Comment Period

The public has the opportunity to speak on any agenda item. All agendas for Advisory Council Committee meetings are posted at the District, 939 Ellis Street, San Francisco, at least 72 hours before a meeting. At the beginning of the meeting, an opportunity is also provided for the public to speak on any subject within the Committee's purview. Speakers are limited to five minutes each.

3. Approval of Minutes of December 3, 2002

4. Discussion of Intermittent Ozone Control Strategies

The Committee will discuss the referral from the Board of Directors and District staff concerning intermittent ozone control measures, focusing on Spare-the-Air Days during the summer. District staff will provide a presentation regarding, and will discuss with the Committee, the District's current intermittent control strategies and ideas on additional strategies for the future.

5. Consideration of Air Quality Planning Committee Referral on Vehicle Inspection & Maintenance (I&M)

The Committee will discuss the referral from the Advisory Council on January 8, 2003 of the Air Quality Planning Committee's Preliminary Recommendation No. 8, adopted January 6, 2003, regarding vehicle I&M.

6. Consideration of Public Health Committee Referral on Particulate Matter Abatement

The Committee will discuss the referral from the Advisory Council on January 8, 2003 of the Public Health Committee document entitled, Particulate Matter Abatement, dated December 10, 2002.

7. Greenhouse Gas Emission Inventory

The Committee will discuss the referral from the Advisory Council on January 8, 2003 of the proposal from the Sonoma County Climate Protection Campaign that the District allocate \$25,000 to support the Campaign and consider further involvement with the Campaign in terms of committing staff resources and the establishing the District as the hub for coordinating regional climate protection efforts.

8. Committee Member Comments/Other Business

Committee members, or staff, on their own initiative, or in response to questions posed by the public, may ask a question for clarification, make a brief announcement or report on his or her own activities, provide a reference to staff regarding factual information, request staff to report back at a subsequent meeting on any matter or take action to direct staff to place a matter of business on a future agenda.

9. Time and Place of Next Meeting

9:30 a.m., Tuesday, April 8, 2003, 4th Floor Conference Room, 939 Ellis Street, San Francisco, California 94109.

10. Adjournment

RH:jc

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
939 ELLIS STREET, SAN FRANCISCO, CALIFORNIA 94109
(415) 771-6000

CLERK OF THE BOARDS OFFICE:
MONTHLY CALENDAR OF DISTRICT MEETINGS
F E B R U A R Y 2 0 0 3

<u>TYPE OF MEETING</u>	<u>DAY</u>	<u>DATE</u>	<u>TIME</u>	<u>ROOM</u>
Advisory Council Technical Committee	Tuesday	4	9:30 a.m.	4 th Floor Conference Room
Board of Directors Regular Meeting	Wednesday	5	9:45 a.m.	Board Room
- CANCELLED -				
Board of Directors Public Outreach Committee	Monday	10	10:00 a.m.	4 th Floor Conf. Room
Advisory Council Public Health Committee	Monday	10	1:30 p.m.	Room 716
Board of Directors Mobile Source Committee	Thursday	13	9:30 a.m.	4 th Floor Conf. Room
Board of Directors Regular Meeting	Wednesday	19	9:45 a.m.	Board Room
Advisory Council Air Quality Planning Committee	Tuesday	25	9:30 a.m.	Room 716
Board of Directors Budget & Finance Committee	Wednesday	26	9:30 a.m.	4 th Floor Conference Room
Regional Agency Coordinating Committee (RACC)	Friday	21	1:30 – 3:00 p.m.	MTC 101 Eighth Street Oakland, CA 94607

MR:mr
1/23/03 (3:55 p.m.)
P/Library/Calendar/Moncal

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
939 ELLIS STREET, SAN FRANCISCO, CALIFORNIA 94109
(415) 771-6000

CLERK OF THE BOARDS OFFICE:
MONTHLY CALENDAR OF DISTRICT MEETINGS
MARCH 2003

<u>TYPE OF MEETING</u>	<u>DAY</u>	<u>DATE</u>	<u>TIME</u>	<u>ROOM</u>
Board of Directors Regular Meeting	Wednesday	5	9:45 a.m.	Board Room
Advisory Council Executive Committee	Wednesday	12	9:00 a.m.	Room 716
Advisory Council Regular Meeting	Wednesday	12	10:00 a.m.	Board Room
Board of Directors Mobile Source Committee	Thursday	13	9:30 a.m.	4 th Floor Conf. Room
Board of Directors Regular Meeting	Wednesday	19	9:45 a.m.	Board Room

MR:mr
1/23/03 (11:20 p.m.)
P/Library/Calendar/Moncal

Bay Area Air Quality Management District
939 Ellis Street
San Francisco, California 94109

DRAFT MINUTES

Advisory Council Technical Committee Meeting
10:00 a.m., Tuesday, December 3, 2002

1. **Call to Order – Roll Call.** 10:03 a.m. Quorum Present: Sam Altshuler, P.E., Chairperson, Bill Hanna, Rob Harley, Ph.D., Stan Hayes. Absent: Norman Lapera, Robert F. Sawyer, Ph.D., P.E.
2. **Public Comment Period.** There were no public comments.
3. **Approval of Minutes of October 8, 2002.** Chairperson Altshuler requested the addition of the following sentence after the first sentence in paragraph four on page four: “Organic carbon is associated with lube oil and elemental carbon is associated with the combustion process.” Mr. Hanna requested “on” be changed to “of” on page two, line five, last paragraph, and the replacement of “Oakbay” with “Oak-Bay” on third line of paragraph two of page seven. Dr. Harley requested that “to two tons” be added after “one” on the final line of the last paragraph of page six, and that “0.1-0.2 tpd” replace “0.01-0.02 tpd” on the first line of paragraph one of page seven. Dr. Harley moved adoption of the minutes as corrected; seconded by Mr. Hayes; carried.
4. **Presentations on Biogenic Emission Inventories**

(A) Development of Biogenic VOC Emission Inventories Using a Geographic Information System (GIS). Development of Biogenic VOC Emission Inventories Using a Geographic Information System (GIS). Klaus Scott, Planning & Technical Support Division, California Air Resources Board (CARB) stated that CARB’s biogenic modeling for the Central California Ozone Study (CCOS) addresses three categories of volatile organic compounds (VOCs): monoterpenes, isoprene and other VOCs (OVOCs) among which methylbutenol is the most important. Foliar emissions of isoprene depend on solar radiation and temperature, while monoterpene emissions are a function of temperature. A number of models indicate that OVOCs comprise between 8-73% of the biogenic VOC emissions in some landscapes. Not all plant species emit these compounds and those that do emit them at various rates and in varying quantities and orders of magnitude.

Modeling efforts attempt to ascertain which plant species dominate a landscape and then evaluate emissions from a variety of adjacent landscapes. Land-use/land-cover databases describe the predominant growth within a modeled domain to obtain biogenic parameters. In addition to the CCOS database, CARB uses a database from the US Geological Survey Biological Resources Division (“GAP layer”) for descriptions of rural canopy cover, and a crop GIS database from the Department of Water Resources that is resolved down to the field level. Few crops emit significant biogenic emissions and those that do emit monoterpenes, which are half as reactive as isoprene. CARB also uses the satellite-derived Leaf Area Index (LAI) database, which provides one square kilometer resolution for the global monthly production of leaf area. California geography is excerpted from the database for use in various state modeling domains.

Using the Mesoscale Modeling System (MM5) to generate temperature and solar radiation fields at 1-km² resolution, the calculation of emissions for the CCOS domain employs emission algorithms within a GIS-based model that account for hourly varying temperature and solar radiation. Species emission factors are provided by Benjamin et al. (1996) and Harley et. al. (1998). Specific leaf weight factors (biomass) are provided by Nowak (USDA Forest Service, Northeast Research Station, Syracuse, New York, 2000). Specific leaf weight factors and leaf area indices are used to calculate leaf mass density in a given area. In his Ph.D. dissertation, Nowak used vegetation surveys to develop profiles of species found in Bay Area urban land uses, which CARB uses. Emission modeling for landscapes is conducted either by assigning emission factors to a variety of predominant plant species and then aggregating them or by applying a generic emission factor to a landscape or ecosystem type. The emission factor is modified by time of day variation in temperature and sunlight. The isoprene emission algorithm adjusts for both of these variables.

Data from the GIS modeling run for the July 29, 2000 ozone episode shows biogenic emissions increasing with temperature and solar radiation as the day progresses and ceasing at dusk. The GAP layer data is applied through detailed area polygons with three wildlife habitat resource or plant assemblages, each of which contains three predominant plant species. The GAP land use/land cover database was generated through vegetation surveys, although some uncertainty remains in the registration of species per polygon.

Species canopy cover, specific leaf weight factors, LAI data and plant species emission factors are used to calculate landscape emission factors at reference conditions (30 °C and 1000 $\mu\text{moles m}^{-2} \text{s}^{-1}$ solar radiation in the photosynthetically active radiation wavelengths) which are diurnally modified using emission algorithms. Isoprene emissions are encoded in the GAP-layered model for such urban land-use contexts as commercial, residential, industrial, transportation and utilities, mixed urban and other urban. Uncertainty exists in the definition of species within a GAP layer. Differences also exist between the “branch enclosure” and “leaf cuvette” methods of measuring biogenic emissions because the latter are two to five times greater than the former. Emission factors are also assigned to some plant species without measurements (based upon taxonomic relationships), while some OVOCs lack emission factors and algorithms.

Approximately 1.3 milligrams of isoprene per square meter per hour are emitted at reference conditions from the polygon upwind of Livermore, which is dominated by Eucalyptus and Coast Live Oak woodlands. This estimate of isoprene emissions occurs prior to environmental adjustment by the isoprene emission algorithm. While Oak, Bay Laurel and Eucalyptus have similar isoprene emission factors, their woodland leaf mass densities significantly differ. While the thinning of the Eucalyptus near Livermore therefore offers diminishing air quality benefits over time, the fire hazard posed by Eucalyptus alone justifies the thinning out of the grove. Chairperson Altshuler suggested it would be helpful to ascertain whether high ozone levels and biogenic levels correlate on weekdays and weekends.

(B) Emissions from a Eucalyptus Forest. Jim Wilkinson, Senior Engineer, Alpine Geophysics, stated that biogenic emissions models account for methane, non-methane VOCs (monoterpenes, isoprene and OVOCs) carbon monoxide (CO) and nitric oxide (NO_x). On a global scale, biogenic emissions of methane far exceed those from anthropogenic sources. Biogenic VOC's exceed those from anthropogenic sources by factor 1.5, while biogenic CO is about one quarter of the anthropogenic CO. Biogenic and anthropogenic emissions of NO_x are equivalent. Monoterpenes, isoprene and OVOCs are associated with plant biochemistry and modeled, whereas methane and CO are

currently omitted. The plant emission factor is multiplied by an environmental correction factor. This result is in turn multiplied by the geographical area. For isoprene, temperature and light correction factors are also used, while “parameterized equations” (i.e., which fit empirical observation) are used for OVOCs, monoterpenes and NO. Unlike the isoprene temperature correction factor, the correction factors for OVOCs and monoterpenes show a continuous emission increases with temperature. However, the potential is high for leaf death at very high temperatures.

From a 900-acre Eucalyptus grove approximately 200,000 grams per hour of isoprene (about two tons per day) would be emitted at peak capacity (cloudless sky on a summer day with temperatures peaking at 40°C (105°F) and 12 hours of daylight). Since the uncertainty factor for isoprene is two orders of magnitude, emissions would range from 0.2 tons to four tons per day. The uncertainty factor is three orders of magnitude for monoterpenes and OVOCs although smaller quantities are emitted. For OVOC and monoterpenes, about 0.1 tons per day would be emitted. It would be hard to pinpoint a signal in a modeling run of the elimination of two tons per day peak emitting capacity from the grove near Livermore. Native Oak and Eucalyptus emit equivalent levels of isoprene. Chairperson Altshuler opined that replacing the Eucalyptus with California Redwood might result in considerably fewer emissions of isoprene.

Chairperson Altshuler inquired if measurements could validate some of these summer estimates. Dr. Harley indicated these detailed calculations establish a maximum range and suggest that 10 tons per day of isoprene will not be eliminated. Also, the eventual replacement over time of a Eucalyptus grove with another tree species that also emits isoprene is of note for future scenarios. How this control measure compares with the total emissions in the Bay Area is less important than how it compares to other ozone precursor reduction measures. Even an interim reduction of two tons of highly reactive organic compounds near an ozone hot spot is desirable.

Chairperson Altshuler suggested that measurements be made to better assess the ozone photochemistry in the Livermore region. Dr. Harley suggested that data from the research site in Sunol that is upwind of Livermore would help in ascertaining to what extent isoprene and oxidation products appear in the samples. Mr. Hess indicated that he would provide that information to the Committee. Mr. Souten suggested adding trajectory analyses to the analysis of the empirical data.

5. **TFCA Transportation Fund for Clean Air (TFCA) Policy Regarding Heavy-Duty Diesel Engines.** Liz Berdugo, TFCA Supervisor, reviewed the history of the TFCA and noted its goal is to cost-effectively reduce vehicular emissions of ozone precursors and particulate matter (PM). Policies governing funding allocation were developed for the Board of Directors in 1992 and are reviewed annually. Presently, an owner of a heavy-duty diesel (HDD) can purchase a new vehicle or re-power it with a new engine with TFCA funds but in both cases only in an alternate fuel mode. Proposed new policy No. 27 would permit vehicle or engine replacement with diesel if it meets CARB standards. Retrofit devices may be installed in conjunction with the use of ultra low sulfur diesel. However, the low sulfur fuel itself will not be eligible for TFCA funding.

This policy will lead to cost-effective emission reductions from engines that would otherwise have continued to pollute. Such TFCA applicants as San Francisco Municipal Railway (MUNI) and the Metropolitan Transportation Commission (MTC) have advocated for PM filters and clean fuels. A new and positive attitude toward diesel has emerged in the environmental field. CARB Chair Alan Lloyd has stated it provides another way to reduce global climate change as well as dependence on foreign petroleum products. “Clean diesel” is now considered feasible with the use of retrofitted

particulate filters and oxidation catalysts. The policy will provide the District with another mobile source emissions reduction tool, thereby increasing the robustness of the TFCA program.

Chairperson Altshuler urged the quantification of all environmental factors in ranking the TFCA projects. Ms. Berdugo replied that emission calculation remains the same for NO_x, PM₁₀ and ROG for all proposed projects. Whether these are alternate fuel, diesel or biodiesel, they will be scored according to the same criteria and will have to meet the same cost-effectiveness threshold. Mr. Shanahan opined that the revision allows the District to significantly reduce NO_x and PM from current engines for the remainder of their operating life. TFCA customers may thus pursue a short-term emissions reduction approach and still aim in the long-term to purchase newer and cleaner vehicles. CNG is also becoming much more feasible for heavier duty vehicle applications.

Dr. Harley inquired if, along with re-powering an existing diesel or purchasing a new alternative fuel vehicle, an applicant can purchase a new, clean diesel vehicle that meets the 2007 emission standards. This would be consistent from an emissions standpoint. Ms. Berdugo replied that Policy No. 24 would not permit this. Mr. Perardi noted that “clean diesel” was previously not considered viable, and so TFCA policies were aimed at promoting alternate fuels. However, the purchase of an entirely new diesel vehicle is also much more costly than re-powering or retrofitting several vehicles. Dr. Harley replied that the new policy allows for funding the purchase of an entirely new alternate fuel vehicle that would also find difficulty in competing with retrofits. Mr. Perardi replied that the District could pay for a fraction of the cost of a new diesel vehicle if the overall cost-effectiveness of that project overall was competitive. This option may be worth further consideration. Mr. Hayes observed that re-powering will invariably achieve greater cost-effectiveness than new vehicle purchases and will lead to more engine re-powering projects.

Chairperson Altshuler opined that TFCA dollars would be better spent on hardware, engines and retrofit devices than on fuel additives, emulsions or biodiesel. The former have longer-term emission reduction implications and should be weighted accordingly. Ms. Berdugo replied that for ranking a project for cost-effectiveness, an applicant must provide an estimate of the lifetime of the equipment. A fuel additive program may last for only one year and the cost is spread out over that period. A retrofit device will last longer, and the benefits are spread out over that time period.

Chairperson Altshuler called for public comment:

Dave Souten
Environ International Corporation

suggested staff discuss this proposed policy revision with the Sacramento Emergency Clean Air and Transportation (SECAT) Program staff. He added that the restriction of TFCA funds to public sector projects excludes the private sector emission reductions. Mr. Shanahan noted that in every other air District, TFCA funding application is across the board. Mr. Hess responded that the District is treated differently from the rest of the state under the TFCA legislation and is even prohibited from using TFCA emission reductions for purposes of air quality planning.

Mr. Hayes inquired if one consequence of the proposed revision in the minds of some observers would be to perpetuate diesel through re-powering and thus continue some level of diesel PM emissions, which have been estimated by some studies to constitute 70% of the air toxics risk in the state. Mr. Shanahan responded that the new policy is an interim strategy to apply clean diesel and

aftertreatment between now and 2007 by using available funds to accelerate emission reductions on engines that would otherwise operate without controls. Major air quality benefits will result.

Mr. Hanna moved the Technical Committee endorse the staff proposal to add Policy No. 27 to the TFCA; seconded by Dr. Harley.

Chairperson Altshuler called for public comment:

Jim Larson
PG&E Clean Fuels Program

expressed concern that transit agencies that have opted for the CNG path may lose TFCA financial support unless there is a cap imposed on funding for these diesel retrofit projects. He inquired if the new policy eligibility includes (a) application of retrofit devices on engines manufactured prior to 1994 and to those that do not require low sulfur fuel, such as an oxidation catalyst applied a CNG engine, (b) CNG as an alternate fuel, along with biodiesel and ethanol. He indicated that he would transmit more detailed written comments to District staff in the near future.

Mr. Hanna observed that adding cost-effective emission reduction options to the TFCA program is inherently desirable. Chairperson Altshuler suggested that staff further facilitate program options by assigning different dollar values to different pollutants where appropriate and factoring in reductions of CO₂ or NO₂. Mr. Shanahan observed the NO₂ issue is being handled by CARB. Chairperson Altshuler replied that the 20% emissions cap for particulate filters becomes effective only in 2004. He added that he would like to see added better quantification of emissions in the TFCA program. Mr. Hanna responded that this might be dealt with elsewhere in the mechanics of the TFCA program. Ms. Berdugo added that there is a TFCA Guidebook that addresses this very issue. Dr. Harley called for the question. The motion carried unanimously.

Dr. Harley added that greater consistency in cost-effectiveness scoring should be given to hybrid and other vehicles in Policy No. 23.

6. **Committee Member Comments.** Chairperson Altshuler thanked the members of the Technical Committee for their participation in the Committee meetings this year.
7. **Time and Place of Next Meeting.** 10:00 a.m., Tuesday, February 4, 2003, 4th Floor Conference Room, 939 Ellis Street, San Francisco, California 94109.
8. **Adjournment.** 12:45 p.m.

Respectfully submitted by,

James N. Corazza
Deputy Clerk of the Boards

Bay Area Air Quality Management District
Memorandum

January 29, 2003

To: Members of the Technical Committee

From: Rob Harley, Ph.D., Chairperson

Re: Referral to Technical Committee on Vehicle Inspection & Maintenance (I&M)

Presented below is the referral on I&M from the Air Quality Planning Committee, along with topical excerpts from the minutes of that Committee as background information.

Text of AQPC Referral to Technical Committee from January 6, 2003:

“The Advisory Council Technical Committee is requested to review the ARB modeling components, and as appropriate, recommend further options for collecting data, reducing the effects of the gross polluting vehicles, evaluate the possible impacts of a program biased toward hydrocarbon emissions, and identify other components of a Hybrid I&M Program that should be included or modified to support the programs goals.”

The Committee agreed to ask the Technical Committee to review the extent to which mobile source emissions modeling could include real-world data and more appropriately address categories of emission reductions applicable to such hydrocarbon-limited areas as the Bay Area.

Excerpts from Air Quality Planning Committee Meetings in 2002-2003:**February 26, 2002 Approved Minutes:**

Vehicle Inspection & Maintenance (I&M). Based on a 1,200 vehicle study conducted in 1994, emission reductions from the 1990 Basic program are estimated at 15% for hydrocarbons, 9% for carbon monoxide and 7% for NOx. Using EMFAC2000, estimates of emission reductions based on the 1996 program improvements are: hydrocarbons - 9%, carbon monoxide - 5% and NOx - 3%. These modeling results are controversial, and further data is to be forthcoming from ARB as to what Basic program is currently doing for the Bay Area. Two independent program evaluations have been conducted for the Enhanced program: one by the ARB as part of the State Implementation Plan requirements, and the other by the I&M Review Committee. Respective emission reductions estimates for the year 2000 are as follows: ARB: ROG reduced by 74 tpd and NOx at 25 tpd. The I&M Review Committee: ROG reduced by 15-79 tpd and NOx by 15-47 tpd based on random road-side surveys, or ROG reduced by 15-48 tpd and NOx by 15-47 tpd based on smog check test data. Mr. Fanai opined the results are fairly close if the average of each were taken as the standard.

Mr. Fanai explained that the California model predicts 178 tpd reduction of ROG and 287 of tpd NOx for the Bay Area in 2004. If the District adopted the full program, an additional 10 tpd of ROG and 16 tpd of NOx would be achieved; however, this is not allowed. The use of dynamometer testing would

increase the failure rate of vehicles in the Bay Area from 8% to about 10% or 11%; however, Tom Wenzel, a prominent I&M expert, believes that most of the reductions from the Enhanced program derive primarily from making sure that high emitting vehicles get repaired properly, rather than from dynamometer testing per se.

April 23, 2002 Approved Minutes:

Continued Discussion of Vehicle Inspection & Maintenance (I&M). Mr. Kurucz inquired if the District were developing more data regarding the expected impact in the Bay Area and on downwind areas for both the optimized basic or enhanced I&M programs. Mr. Tom Perardi, Planning Division Director, indicated that past modeling results do shed some light on this question and indicate the impacts are quite small and fairly limited in scope and would not result in a change in the attainment status within the District region or downwind of it. Consideration is being given by the District to have further modeling conducted by a third party, perhaps in concert with local academic institutions. Inquiries to CARB to conduct such modeling have been answered with the argument that photochemical models do not have sufficient resolution to evaluate a single control measure like enhanced I&M, though District modelers do not entirely agree. Mr. Shanahan observed that both the San Joaquin Valley and Sacramento areas strongly believe that enhanced I&M in the BAAQMD would help them reach attainment, and Mr. Perardi added that these areas perceive this also as a fairness and equity issue as well. Technical analysis can provide more information on the potential impact of such programs. Mr. Shanahan inquired as to the costs of outsourcing of such modeling, and Mr. Perardi replied that several tens of thousands of dollars would be required as such modeling runs are complex and involve considerable analysis.

July 23, 2002 Approved Minutes:

Continued Discussion of Vehicle Inspection & Maintenance (I&M). Mr. Amlin [Bureau of Automotive Repair] noted that in the Enhanced program's Accelerated Simulated Mode test, emissions of hydrocarbons (HC), carbon monoxide (CO) and nitric oxide (NOx) are measured. A gas cap test and a liquid leak test have also been added to the program statewide. Heavier duty non-diesel vehicles weighing more than 8,500 pounds have also been included in the program, thereby increasing the number of vehicles tested by 1-2%. Every year half of the state's vehicle fleet is therefore tested, except for brand new vehicles which are exempted from I&M for the first four years, as well as vehicles older than the 1974 model year.

Chairperson Glueck inquired as to the possible correlation between the widely quoted estimate that 10% of the vehicles are responsible for 50% of the on-road emissions to the statistic that indicates 15% of the vehicles in the Smog Check program fail the test. Mr. Amlin replied that the initial estimation is somewhat oversimplified and does not track precisely with the test failure rates, nor does it apply to all pollutants. Although such experts as Lawson and Steadman estimate that 10% of the vehicles may be responsible for as much as 80% of the emissions, the subject gross polluting vehicles (GPVs) are barely functional and as such have low mileage and thus low on-road emissions. Older cars also emit more than the fleet average even if they are repaired. Roadside test failure rates are higher than Smog Check test failure rates because some owners simply repair their cars before they are tested. The 10% vehicle subset that fails during one month may not be the same subset the next month.

In discussion of whether the I&M program successfully identifies and facilitates the repair or scrapping of the GPVs, Mr. Amlin noted that a small percentage of the vehicles put through the system do not get repaired, although even some repaired vehicles may fail the Smog Check test a month later.

An annual testing cycle would capture more of the vehicles that failed the test within a year of their repair. Next year the BAR plans to study statewide the data on follow-up tests of vehicles that initially fail the test. Oregon is the only state that disallows waivers, and there were only 181 waived vehicles operating in the Bay Area last year. The availability of a fully funded vehicle repair and retirement programs leads to the further reduction of the number of waivers.

Mr. Altshuler inquired if in 1996 the BAR observed a reduction in vehicle test failure rates following the Bay Area's conversion to reformulated gasoline (RFG) in 1995. Mr. Amlin stated an immediate drop in vehicle failure rates was observed, although this result is somewhat tentative because BAR emissions analyzing equipment could not read all of the hydrocarbon emissions produced by RFG. With the conversion from MTBE to ethanol, further changes in vehicle failure rates may be observed.

August 20, 2002 Approved Minutes:

Continued Discussion of Vehicle Inspection & Maintenance (I&M). Mr. Lawson, Principal Scientist, National Renewable Energy Laboratory (NREL), Golden, Colorado, stated that although he is a member of the Colorado State Air Quality Control Commission, his presentation reflects only his own personal opinions based on technical data. Mr. Lawson noted that NREL's 1986 tunnel study in Los Angeles discovered that on-road emissions of cars and trucks were far greater than suggested by the California Air Resources Board (CARB) emission factor model (EMFAC) which underestimated volatile organic compound (VOC) emissions by a factor of 3 to 7, and carbon monoxide (CO) by a factor of 3 to 4, although measured levels of nitric oxide (NOx) were fairly close to the levels predicted by EMFAC.

Mr. Lawson emphasized the importance of understanding the dynamics of Bay Area ozone photochemistry for I&M program evaluation. NREL's recent analysis of Los Angeles weekday and weekend ozone concentrations found that ozone concentrations were 28% higher on Saturdays, and 50% higher on Sundays, while NOx was 40% lower on Saturdays and 65% lower on Sundays. Both the South Coast and the Bay Area are "VOC-limited": that is, reductions of VOCs reduce the formation of ozone, while NOx reductions increase it. This has implications for Enhanced I&M with its loaded-mode testing, which measures NOx emissions. NREL's follow-up PM nitrate study in Los Angeles has been unable to reveal any statistical difference between weekdays and weekends despite major reductions in ambient NOx levels.

A comparison of smog chamber and ambient data for NOx and VOCs from 1987-2001 at four monitoring stations in Southern California shows that changes in ozone levels are entirely due to changes in VOC levels. In next evaluating the difference between these ambient data and the emission inventory, NREL conducted source apportionment for gasoline exhaust, gasoline liquid, gasoline vapor, diesel exhaust, compressed natural gas, surface coatings and consumer products, and concluded that 80% of ambient measurements derive from mobile sources. This contrasts with CARB's estimate of 60%. This discrepancy requires resolution because a bad emission inventory creates bad control strategy. In VOC-limited areas, the best way to reduce ozone is to reduce mobile source emissions of VOCs. This reduces both the precursor and a great deal of ozone that would otherwise be transported to downwind areas. In such circumstances it would not matter whether such downwind areas were VOC- or NOx-limited.

GPV's were first identified (called "outliers") and reported to the CARB in a 1983 vehicle emission study by researchers Wayne and Horie, as follows: "A further important consequence of this highly skewed distribution is the fact that emissions from vehicles at the outer end of the distribution

contribute disproportionately to emissions and emission factor estimates... Since outliers contribute a large fraction to the total emissions it is more important to know their contribution accurately than to know accurately the relatively minor contributions of low-emitting vehicles.” This skewness has since been manifest in every survey whether based on Federal Test Procedure (FTP) data, remote sensing or real world survey data of on-road idle tests. Between 1975 and 1992 the Environmental Protection Agency (EPA) annually pulled over 500 vehicles in each of 15 separate locations in the country and subjected them to an idle test to obtain information on tampering. NREL analyzed the data from this survey for tailpipe emissions of CO, HC, NO_x and PM by dividing the cars into model year groups, rank ordering them within model year from one (cleanest) to ten (dirtiest), and then calculating the average within each decile. NREL found not only that as vehicles got older emissions increased but also that a notable fraction of new cars are also fairly dirty. NREL traced the impact on air quality for all four pollutant categories of each decile within each model year from one year to the next and found that the decile with the GPVs moved steadily forward without any major reduction. The results explain why after 35 years of installing pollution control equipment on vehicles the national ambient air quality standards have not been achieved. They also confirm the view that a high level of emissions derives from a small percentage of the vehicle fleet.

Data from a California roadside survey of 13,000 vehicles indicates GPVs are similar for VOCs and CO, but not for NO_x. While GPVs are found in nearly every model year, the majority of vehicles in each model year are comparatively clean. Lack of maintenance is the key issue for GPVs. As the fleet becomes cleaner, the fraction of fleet producing the majority of total emissions becomes smaller. For “repairable” emissions, 5% of the fleet produces 75% of the emissions of CO, 83% of the emissions of VOCs, and 85% of the emissions of NO_x.

Remote sensing is accurate to within 5-15% for emissions of CO and HC. It has the advantage of measuring on-road emissions and has a low false failure rate, in contrast with the 90-95% false failure rate of conventional I&M. Some studies indicate that GPVs also have significant evaporative emissions. Remote sensing cannot measure these, but neither can conventional I&M except from the gas cap. Certain conditions are also needed for effectively siting remote sensing devices, such as a level street or a lengthy, curved on-ramp with a slight upward grade.

Federal and state regulatory emission models give little credit to remote sensing because they presume the maximum effectiveness of I&M programs. A factor for remote sensing could be included in such models but would not be based on actual data. Mr. Hess inquired if EMFAC should not be used to judge the effectiveness of I&M. Mr. Lawson stated it should not, adding that independent evaluations of I&M show the actual emissions reductions are only from zero to one-half of that predicted by the models. These independent evaluations are unrefuted to this day. On-road measurements in Colorado show only a 10% reduction in CO, while the EPA’s MOBILE 5b emission model predicts a reduction of 34%.

Mr. Hanna noted that the UC Riverside modeling results conveyed to the Board Executive Committee on July 31 indicated that Enhanced I&M would lead to a 1% ozone increase in Livermore and a 1% decrease Sacramento. With an incremental cost of an additional \$6 per test for the 2.2 million vehicles tested annually in the Bay Area, a cost-benefit does not result. Mr. Lawson replied that the credit given in the model by CARB to Enhanced I&M of 10 tons per day (tpd) of HC and 16 tpd of NO_x must be evaluated in light of independent evaluations of I&M which show the actual benefits are only one-third of the predicted emission reductions.

Mr. Hanna inquired about how to counteract the problem of building into a mobile source emission model presumed emission reductions which in reality are much less. Mr. Lawson replied that, in the interest of air quality, such models must use real-world data, such as the decile plots previously cited. Even if Enhanced I&M is imposed on the Bay Area, the same air quality problems will persist. A hybridized approach to I&M will prove a challenge as CARB has long been opposed to remote sensing. However, a forthcoming remote sensing study to be conducted by BAR represents a major step forward. Future reductions in VOCs will have to be obtained from the road, since the emission inventory presently provides little or no room for additional significant reductions of VOCs from other sources.

September 24, 2002 Approved Minutes:

Continued Discussion of Vehicle Inspection & Maintenance (I&M). Bob Lucas, Lobbyist, California Council on Environmental and Economic Balance (CCEEB), stated that the task before the District is to develop an I&M program that maximizes emission reductions and optimizes consumer acceptance. Nitric oxide (NOx) is thoroughly controlled in the Bay Area, but additional hydrocarbon (HC) reductions are needed to further ozone reduction. Therefore, the District I&M program should identify and reduce emissions from HC-rich gross polluting vehicles (GPVs).

Historically, jurisdictional guidance of the state I&M program has been shared by the California Air Resources Board (CARB) and the Bureau of Automotive Repair (BAR). CARB and BAR recently administratively fine-tuned the I&M program by adopting more stringent test cut-points and rules that penalize the fraudulent practice of “clean piping” vehicles that would otherwise have failed the I&M test. CARB’s policy direction has been guided by its emission factor (EMFAC) modeling, the assumptions of which conflict with the results of on-road testing studies that ascribe significant emissions to GPVs. The recent analysis by Doug Lawson of Colorado’s National Renewable Energy Laboratory confirms the Weekend Effect in Southern California. The results should be addressed at the state level. CARB advocates NOx control to reduce nitrate which, in turn, reduces particulate matter (PM). However, Mr. Lawson’s analysis reveals that nitrate levels remain constant even on weekends in the South Coast when NOx levels are much lower.

CCEEB has expressed its concern about the adverse impact on voluntary vehicle retirement programs of the more generous amount offered per scrapped vehicle by I&M. CCEEB has also advocated for accurate emission reduction estimates from voluntary scrap programs and the use of remote sensing to identify GPVs between I&M tests. Due to recent technological and methodological improvements there is now much more data supporting than discouraging the use of remote sensing to identify GPVs for emissions of carbon monoxide (CO) and HC. While both CARB and BAR have historically been reluctant to utilize remote sensing, each has recently appropriated funds for remote sensing pilot projects.

Mr. Lucas responded to Committee member questions on a number of subjects as follows:

The Need to Improve Modeling Associated with I&M. I&M mobile source emission models have not been sufficiently fine-tuned to accurately represent the true contribution of mobile sources to the mix. While EMFAC is routinely improved it never correlates well with actual measurements. Thus, compliance demonstrations to date are based on modeling structure that has yet to reach an optimum level and imposes impediments in the choice of the program that responds to the emission reduction need. CCEEB has advocated for a voluntary vehicle retirement program funded through recognition of emission reductions attained through that program. However, CARB ascribes such reductions from

the voluntary scrap program to the I&M program because the EMFAC model assumes they operate at cut-point levels.

Emissions Accounting. Gary Kendall, Technical Division Director, stated that the attainment planning process must demonstrate through modeling how attainment will be reached and is not connected with ambient measurements. Mr. Lucas replied it is necessary to find a way to imbed better and more comprehensive emission accounting within I&M itself. Off-cycle annual checks and/or remote sensing checks could document emission reductions and provide the data on what happens to vehicles between I&M tests and also on vehicle repair longevity.

Merging Eligibility Criteria for State and Voluntary Vehicle Retirement Programs. CARB has recently conformed the eligibility requirements of the voluntary vehicle retirement programs with those of the state scrap program. The opportunity may arise to merge them into a single voluntary scrap program comprised of two entry points. A vehicle captured by the state I&M program could then be brought into the District's voluntary scrap program. Remote sensing could be used to ascertain whether a vehicle is eligible for the District's program and to quantify emission reductions. This would create a database for emission credits that could be fed into an emission factor model. BAR also maintains a large emission database for scrapped vehicles which could be used to quantify HC emission reductions from voluntarily scrapped vehicles that the state I&M program would otherwise assume are operating at cut-point levels.

Combining Remote Sensing with Enhanced I&M. Given that the District has offered to host CARB's remote sensing pilot project, any advocacy of remote sensing should take into account the modeling requirements that CARB faces regarding compliance demonstration.

On-Board Diagnostics (OBD) as a Substitute for I&M. OBD identifies a completely different set of vehicles from the set that would be identified as GPVs by I&M.

October 31, 2002 Approved Minutes (Excerpts):

Continued Discussion of Vehicle Inspection & Maintenance (I&M). Chairperson Glueck stated the goal is to optimize the Enhanced I&M program by further reducing vehicle emissions and obtaining public acceptance. The following key issues have arisen in the Committee's discussions:

- the need for the Bureau of Automotive Repair (BAR) and the District to fully recognize the contribution of gross polluting vehicles (GPVs) to the mobile source emission inventory, and to install remote sensing devices in the region to measure their contribution.
- improvement of current mobile source emission models to identify the contribution of GPVs and to utilize real-word data from roadside tests and remote sensing.

Mr. Kurucz noted that with regard to CARB's pending review of the ozone impacts identified by the U.C. Riverside transport study, the Technical Committee should also receive presentations from CARB on such data and present its findings at the subsequent full Council meeting. The Committee agreed that the modeling issues referred to the Technical Committee are long-term and could be separated from the other recommendations. Chairperson Glueck added that if the District sponsors a remote sensing program, it could begin to acquire more realistic on-road data over the long-term that could eventually be incorporated in mobile source emissions modeling.

December 10, 2002

Draft resolution concerning PM2.5, for consideration by the Public Health Committee; referred by the full Council to the Technical Committee on January 8, 2003:

DRAFT

To: William Hanna, Chairperson, and Members of the Advisory Council

From: Brian Zamora, Chairperson, and Members of the Public Health Committee

Subject: Particulate Matter

Topic

Reduction of particulate matter (PM).

Importance/Implications

The District will soon be responsible to further reduce PM10 and PM2.5 in the Bay Area as a result of more stringent state standards. The revised standards result from a large body of evidence that PM contributes to premature death and multiple health conditions in the population; there is particular concern about the growing numbers of children with asthma. Continuing reductions in PM will require multiple and creative programs on the part of the District.

Recommendations

1) The Council applauds the District's rejuvenation of the "Don't light tonight" program. We strongly recommend that the District develop and implement a multi-year plan, with milestones and a timetable, to reduce the District's current 65 ug/m³ trigger (the national 24-hour standard) to the PM 2.5 air quality subindex of 40. u/m³. That is a level which USEPA has determined causes unhealthful effects in sensitive groups.

We also recommend that the District:

2) evaluate the "Don't light tonight" program with regard to public awareness and actions taken in response to the alerts.

3) map PM concentrations in areas of likely concern (e.g., populated inland valleys) during winter days and nights, including weekends, using appropriate portable PM monitoring devices. These efforts should examine temporal PM profiles, not just 24-hour averages. The information will assist in determining control strategies, publicizing the problem, and building public awareness and support for District efforts.

- 4) for both educational and data-gathering purposes, give grants and support others' grants to school districts to buy portable PM monitoring devices for student use, or loan such devices to school districts to map local emissions. Provide technical support for this effort, and seek coordination with local health and environmental health officials. (Appropriate devices are now relatively inexpensive.)
- 5) compare real-time and 24-hour average PM data from regional District monitors to see if they reflect micro-environmental PM concentrations tracked under (2) and (3) (above).
- 6) consider making the case for fireplace change-out on sale of a home, a provision omitted from the District's model ordinance on wood smoke, which now addresses only new sources of wood smoke, i.e. new home construction. Continue to seek funding for change-out programs and other incentive programs, especially in areas of likely concern and other areas identified through activities in (3) above.
- 7) continue to provide dedicated staff support for advocacy of the wood smoke ordinance and its adoption by local jurisdictions.
- 8) continue its support for a CARB resolution on diesel bus idling near schools. Support bus design changes so that air conditioning and heat do not require idling. Look at other situations where buses congregate and idle where there are large numbers of people (e.g., airports) to see whether a similar ban would be warranted.
- 9) reconsider the use of emissions credits for PM reductions.
- 10) *[Additions e.g. from the Technical Committee re: particulate trap retrofit program for public transit buses?]*

Key Issues

1. Particulate matter (PM) is associated with an increased death rate overall and from specific diseases, such as respiratory and cardiovascular disease. Between the least and most polluted cities in the United States, the average life expectancy reduction is estimated at 1.5 years less for every PM increase of 50 ug/m³. Some 200 Bay Area residents die prematurely from elevated PM levels, according to risk assessments.

2. PM is also associated with many illnesses, as reflected in studies showing associations with cardiovascular and respiratory hospitalizations, emergency room visits, school absenteeism, asthma attacks, bronchitis and other respiratory symptoms in children, and decreased lung function. Recent studies suggest that exposure during pregnancy may be related to birth defects, low birth weight, prematurity and infant mortality.

Another recent study showed elevated lung cancer deaths in areas with higher PM.
[C. Arden Pope et al. (2002) "Lung Cancer, Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Pollution," *Journal of the American Medical Association*, Vol. 287, No. 9.]

3. Studies also point to woodburning as a significant source (when multiplied by thousands of lighted fireplaces) of two of the toxics that were recently identified as having a differential impact on children: dioxin and dioxin-like compounds, and polycyclic aromatic hydrocarbons. CARB is in the process of evaluating these compounds under SB 25 for further toxic control measures.

4. No threshold has been detected below which health effects do not occur.
5. A number of issues remain unresolved, including the PM size and composition most associated with various health effects and the mechanism(s) that causes the effects. Nonetheless, the consistency in the research findings noted above has produced a consensus that PM is a significant public health problem.
6. CARB is expected to issue new regulations to achieve the lower standards for PM10 and PM2.5, likely early in 2003.
7. Bay Area monitoring data show that, although the District has a long history of regulating PM and trends in PM10 are downward for the last 15 years, several sites will not meet the new annual-average state standards of 20 ug/m³ for PM10 and 12 ug/m³ for PM2.5. Elevated PM here occurs especially from October through January; the two principal (and roughly equal during this time period) sources on an annual basis are wood smoke and cooking, and fossil fuels (principally from mobile sources).

Information Considered

Members considered reports to the Committee from:

- Dr. Bart Ostro, Cal/EPA-OEHHA, co-author of “Staff Report: Public Hearing to Consider Amendments to the Ambient Air Quality Standards for Particulate Matter and Sulfates,” May 3, 2002 (Cal/EPA-OEHHA and ARB);
- Dr. David Fairley, District Statistician, BAAQMD, author of “Daily Mortality and Air Pollution in Santa Clara County, California: 1989-1996,” Environmental Health Perspectives, Vol. 107, No. 8, August 1999;
- Mr. Thomas Perardi, Planning Division Director, BAAQMD;
- and information from Michael Lipsett et al., “Air Pollution and Emergency Room Visits for Asthma in Santa Clara County, California,” 1997 Environmental Health Perspectives, Vol. 105, pp. 216-22.

Deliberative Process

The Public Health Committee was asked to consider this topic by Council Chairperson Sawyer as part of its work for 2002. The Committee met on February 25, April 29, June 17, September 9, October 28, and December 9, 2002 to receive and discuss presentations on the issues. The Committee unanimously arrived at its recommendation for forwarding to and consideration by the full Advisory Council.

January 8, 2003 Draft Minutes of Advisory Council Regular Meeting/Retreat re: Referral:

Public Health Committee Meeting of December 9, 2002. Mr. Zamora reviewed the memorandum entitled “Particulate Matter” (PM), dated December 10, 2002, which presents recommendations on improving PM abatement within the District. He noted that their review by the Technical Committee, particularly the item on diesel PM traps, is desirable. In reply to Council member questions, Ms. Blake stated the following:

- Diesel locomotive idling and heavy-duty diesel truck idling were not addressed. Transit and school buses have been the primary focus over the years and the latter were addressed in a recent CARB rule. The recommendations could be updated to reflect CARB’s action.
- Based on data provided to the Committee by District Statistician Dr. David Fairley, woodsmoke PM is a significant PM source year-round throughout the Bay Area.
- The District should re-examine its current policy on the use of PM emission offset credits.
- The basis for recommending the mapping of PM on a temporal resolution of less than 24-hours is aimed at better understanding PM source apportionment.

Mr. Altshuler stated discussion at the Technical Committee level would prove helpful as PM chemistry and size are important relative to toxicity, and diesel PM is more toxic than woodsmoke PM. Back-up generators (BUGs) are additional PM sources of concern. Mr. Shanahan and Ms. Weiner recommended the Committee review a document on BUGs prepared by the Environmental Defense Fund (EDF) and receive a presentation from EDF member Nancy Ryan. The Council reached consensus that the recommendations be referred to the Technical Committee. Dr. Harley indicated the Committee would review them in February.

Excerpt from April 29, 2002 Approved Public Health Committee Minutes:

Review of Particulate Matter Ambient Air Quality Air Standards Proposed by the California Air Resources Board and the Office of Environmental Health Hazard Assessment. Dr. Bart Ostro, Chief of the Epidemiology Unit, Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA) stated he would review the process by which standards are set for particulate matter (PM), the health effects associated with PM, and the proposed recommendations to modify the standard, as well as newer studies and scientific uncertainties. SB 25, the Children’s Health Environmental Protection Act which was passed several years ago, requires periodic review of the standards, with the aim of determining whether a standard adequately protects public health.

OEHHA has been asked to conduct pollutant review, and prioritize the review of air quality standards and ascertain if these adequately protect public health, focusing on infants and children. OEHHA’s interim review was completed in December 2000, and included two priority tiers. The first included PM₁₀ and sulfates, ozone and nitrogen dioxide, and the second included lead, hydrogen sulfide, sulfur dioxide and carbon monoxide. The Air Resources Board (ARB) requested OEHHA expedite its review of the PM standard and its recommendations will be publicly heard at the ARB this June. Once the standards are set, monitoring strategies ensue, an emission inventory is developed, modeling and transport issues are evaluated, and control strategies implemented.

PM is of concern because much evidence has been amassed since the last review in 1980, with regard to associations with premature death, cancer, and cardio-respiratory disease, as well as specific impacts

on children. For PM₁₀, the state standard for annual averages is 30 µg/m³ and 50 µg/m³ for a 24-hour average. For sulfate the standard for a 24-hour average is 25 µg/m³. PM₁₀ typically derives from soil, dust, silica, salts, pollen, and tire rubber, and finer fractions such as PM_{2.5} derive primarily from sulfates, nitrates, carbon, lead and organics. PM is either directly emitted—i.e., from diesel engines, woodsmoke—or forms through photochemical processes, such as the conversion of sulfur dioxide or nitrogen dioxide into nitrates and sulfates.

Ambient air quality standards are based on epidemiological studies, using real-world exposures and health responses, with the aim of examining different segments of the population, health-related behaviors, and health conditions. Statistical associations are used, rather than actual observed effects, to infer the effects of air pollution. Studies range from short-term (exposures of a few days to a week) to long-term (a year to several years). Short-term studies of PM₁₀ and PM_{2.5} for mortality have been conducted in over 200 cities, examining daily levels of air pollution and daily counts of mortality in a given city over 3-4 years, and ascertain if daily changes in air pollution are associated with daily counts of mortality. All published studies in last 10 years also account for weather effects, seasonality, and even the day of the week.

Recent multi-city studies, including one which looked at the 90 largest cities in the US, the Harvard Six Cities study, the 10 U.S. Cities study by Schwartz in 2000, a study of the eight largest Canadian cities, a study of 29 European cities, plus 64 single-city studies using different PM metrics (coarse, PM, coarse particles, black smoke, coefficient of haze, and extinction coefficient) show associations between daily or multi-day averages and all-cause mortality, and disease-specific mortality, such as respiratory and cardiovascular mortality, and mortality. A number of statistical confounders were eliminated from analyses of these studies—such as climate and seasonal patterns, PM concentrations and various mixtures, co-pollutants and weather co-variations, and population characteristics and housing stock—and over all of these types of patterns, relatively consistent statistical effects were seen from particles.

The results suggest that most studies of PM₁₀ show increments in daily deaths of between 0.5 and 1.5% per 10 µg/m³ increase in PM. There is greater uncertainty about such association among studies conducted at lower concentrations. Also within these short-term studies, associations were reported between daily PM₁₀ and many other measures of illness, such as cardio-vascular and respiratory hospitalizations, emergency room visits, school absenteeism, asthma attacks, bronchitis and other respiratory symptoms in children, and decreased lung function.

Regarding PM Epidemiology Studies for long-term exposure to PM₁₀ and/or PM_{2.5}, several report associations between mortality outcomes. The American Cancer Society cohort, with 550,000 individuals studied in 151 cities since the 1950's, found that cardiovascular mortality and lung cancer mortality were also associated. These studies account for relevant individual-level risk factors (smoking status, weight, alcohol, occupational exposures, gender, and age). After controlling for individual risk factor, the studies inquire if individuals in areas with higher pollution have shorter longevity, and the answer is in the affirmative, according to a recent paper for cardiovascular and lung function. Areas with higher PM₁₀ levels are estimated per year to be 4 to 7% per µg/m³. Between the least and most polluted cities in the US, the average life expectancy reduction is estimated at 1.5 year less per PM increase of 50µg/m³.

Other results from short and long-term exposure studies are that (a) the nine available time-series short-term exposure studies indicate a set of mixed results, and (b) most analyses fail to detect a

response threshold because many studies are conducted at low concentrations and even statistical approaches using flexible models have been unable to detect such a threshold.

Additional results are that mortality displacement appears to be minor; composition-specific studies suggest combustion-related PM is most toxic, of which PM may serve as a surrogate. There is a need to carefully control for weather and other potential confounders, and as this has been done, it appears that these effects are not related to co-pollutants or seasonality.

The rationale for the new PM standards is drawn from the hundreds of studies published in the last decade confirming linkages with mortality and morbidity and PM exposures near or below current ambient concentrations, for both fine and coarse particles, and short- and long-term exposures. OEHHA therefore recommended both annual and 24-hour standards for PM₁₀ and PM_{2.5} at levels below those concentrations where effects were consistently observed for elderly people, asthmatics and children. OEHHA identified the mean as the most likely effects level and moved the standard below the level at which the effects are consistently observed. This level is a generally protective level for the population, although not a zero-risk criterion per se.

Dr. Ostro compared existing and proposed PM standards by the US EPA, California, and the European Union, and estimated the following health benefits from the reduction of PM from the existing to the proposed standards: 6,500 fewer deaths; 3,100 fewer cardiovascular hospitalizations, 1,000 less asthma hospitalizations, and 2,900 fewer respiratory hospitalizations among those greater than age 65; and 389,000 fewer respiratory symptoms among children aged 7-14. He added that there are several new findings from PM epidemiology studies: short-term PM exposure appears to be related to heart attacks and arrhythmias; and exposure during pregnancy may be related to birth defects, low birth weight, prematurity and infant mortality. An ARB funded study in Southern California of 3,500 children found significant asthmatic effects but could not distinguish between high levels of ozone and PM in ascertaining the primary cause.

Unresolved issues in PM analysis include (a) what subfraction of size and composition is most important for health effects; (b) whether early-life exposures have a long-term impact; (c) if there are other sensitive population subgroups; (d) the effects of proximity to roadways; and (e) the underlying mechanisms for health impacts. PM appears to be adverse for human health, and mobile sources seem to be the worst. Much scientific peer review has been conducted and the analyses seem to hold up under a wide range of scrutiny, and thus provide a cause for concern.

Excerpt from June 17, 2002 Approved Public Health Committee Minutes:

Discussion of Issues Concerning Particulate Matter. Dr. David Fairley, District Statistician, noted the highest annual average PM₁₀ measurement in the Bay Area is found at the San Jose 4th Street station. The District is not presently in violation of either the current state standard or the national annual standard, but several sites would be in violation of the proposed new state standard. The District currently meets the national annual PM_{2.5} standard but it would violate the proposed annual state standard and the proposed 24-hour PM_{2.5} standard. Since 1992, the District has attained the national 24-hour PM₁₀ standard and continues to do so. The District violates the state 24-hour PM₁₀ standard at a number of sites and meets the current federal 24-hour PM_{2.5} standard, but the proposed new standard would be difficult to reach.

Dr. Fairley noted that PM is seasonal with the highest levels occurring in October for PM₁₀ and December for PM_{2.5}. To more precisely ascertain the annual and wintertime contributors to PM₁₀ and

PM_{2.5}, chemical mass balance analysis was conducted of filter samples at the San Jose 4th Street station for geological dust, ammonium nitrate, ammonium sulfate, wood smoke, cooking, fossil fuels and marine sources. New carbon (woodsmoke/cooking) was distinguished from old carbon (fossil fuels). From an annual perspective, PM₁₀ consists of a fair amount of geological dust, although there is less of this constituent in the wintertime. Ammonium nitrate is a larger source both annually and in the winter. Ammonium sulfate is found at roughly equal levels annually and in the winter at about half the level of ammonium nitrate. Both ammonium nitrate and ammonium sulfate are secondary pollutants that form in the atmosphere and are not directly emitted. Woodsmoke a major source of PM and during the wintertime it is the largest contributor to PM_{2.5}. Motor vehicles and power plants are the major sources of fossil fuels, and the level of fossil fuel contribution is about equal to that of wood smoke on an annual average.

A comparison of geological and combustion PM—as recorded by filter sample measurements versus what the emissions inventory estimates—reveals that geological dust is estimated as being much greater in the inventory than combustion PM whereas the filter measurements show the opposite. This result may be due to the fact that geological dust consists mainly of coarser particles, and coarser PM falls out of the air more quickly so that less reaches the monitors.

Trend analysis for Bay Area PM₁₀ levels derived measurements at eight sites during 1987-2000 and adjusted for San Francisco rainfall indicate a 25% reduction during this time. Nitrate, sulfate and the Coefficient of Haze (COH) show a downward trend but sea salt does not. COH shows a 71% reduction. The explanation for this result is not fully known, but is due in part to reduced diesel emissions. The District has measured COH since 1970 at Napa, Concord, Redwood City and San Jose. COH levels remained consistent until 1990, after which a significant reduction was observed at every monitoring site.

Assessments of annual emission trends for PM₁₀ based on emissions inventory data from 1980, 1991 and 2002 show diesel decreasing, but an increase in cooking/wood, refinery and industrial combustion, gasoline, road dust, and construction/farm dust. The emission inventory does not corroborate what has been analyzed from ambient measurements on filters. Some genuine improvements in ambient air quality may not be being reflected in the emission inventory models.

Dr. Fairley concluded that PM appears to be the most serious ambient air contaminant in the Bay Area. It is estimated that approximately 200 residents per year die prematurely from elevated PM levels. While the Bay Area meets the current national standards, it will violate the California standards for the foreseeable future. The largest PM sources are woodsmoke, direct fossil fuel emissions and ammonium nitrate. Ammonium sulfate is a lesser, though significant, contributor. Geological dust is much less important than the emissions inventory would suggest. There has been a 20%-30% downtrend in every PM constituent since 1987 except for sea salt. The apparent downtrend in carbonaceous species of PM is not reflected in the emission inventory. As collective single sources fuel and woodsmoke/cooking appear to be relatively equal and constitute a large percent of the total PM_{2.5}.

Excerpt from September 9, 2002 Approved Public Health Committee Minutes:

The District has a long-standing history of regulating PM. In 1957, Regulation 1 prohibited garbage burning in backyard trashcans. Since then District PM reduction efforts include:

- regulating agricultural burning
- setting opacity limits for power plants, refinery furnaces, boilers, demolition and construction projects and other sources of fugitive dust
- setting mass emission limits for new and modified sources, with the requirement to apply Best Available Control Technology (BACT) for all categories of pollutants
- abating woodsmoke through the “Spare the Air Tonight” program and a campaign aimed at replacing uncertified wood burning devices with certified stoves or natural gas
- requiring application of Best Available Retrofit Control Technology (BARCT) on electrical generation units, petroleum refinery heaters and boilers, stationary gas turbines, non-refinery heaters and boilers, home water heaters and internal combustion engines
- promulgating NOx reduction rules reduce downwind ozone generation and local PM as secondary nitrate is major component of PM on episode condition nights in the winter
- publishing California Environmental Quality Act (CEQA) guidelines for cities and counties which provide dust control measures for construction and development projects
- providing funds to school districts to replace old diesel buses with clean new buses or to install PM filters on certain engine families on which these filters are effective
- sponsoring a \$3.5 million program to scrap old vehicles
- sponsoring a \$100,000 program to replace old lawnmowers

Since 1987, ambient measurements of PM₁₀ in the Bay Area have declined by 25%. The ultra-low sulfur diesel fuel—down to 15ppm from 300ppm—that is due in the region in 2004 will provide major sulfur compound reductions and render more effective the PM traps that will be installed on heavy-duty diesel vehicles at that time. CARB is seeking a transporter agreement with states that are adjacent to California as well as with Mexico with regard to inter- and intra-state trucks to prevent heavy-duty diesel truck drivers from circumventing the ultra-low sulfur fuel requirement by fueling to capacity outside of the state.

Mr. Perardi noted that the San Joaquin Valley and Mojave Desert Air Districts must produce plans to meet the federal PM standard. Ms. Mayfield added the San Joaquin Valley is developing a residential woodsmoke abatement program. Mr. Hess added that the open burning regulations adopted by the District last December will reduce PM from prescribed burning. “All feasible measures” to reduce PM will be adopted as required by the CCAA. The District recently adopted a CARB program to install PM filters on 250 city and county heavy-duty diesel fleet engines.

Excerpt from Air Quality Planning Committee Meeting Approved Minutes of August 20, 2002:

With regard to emerging subjects regarding vehicle emissions, Mr. Lawson [National Renewable Energy Laboratory, Colorado] added that there is increasing concern over PM from mobile sources as new data reveals there is much more PM from gasoline vehicles in urban areas. There may also be more toxicity from spark emission engines than from diesel engines, and for GPVs the toxicity increases per unit of mass.

Bay Area Air Quality Management District
Memorandum

January 29, 2003

To: Members of the Technical Committee

From: William T. Hanna, Advisory Council Chairperson

Re: Referral to Technical Committee on Regional Greenhouse Gas Emission Inventory

Presented below is an excerpt from the draft minutes of the January 8, 2003 Advisory Council Regular Meeting/Retreat in which the issue of a regional greenhouse gas emission inventory was referred to the Technical Committee:

Excerpt from Draft Minutes of Advisory Council January 8, 2003 Regular Meeting/Retreat:

Greenhouse Gas Emissions Inventory. Mike Sandler and Ann Hancock of the Sonoma County Climate Protection Campaign (SCCPC) stated that 137 cities and local jurisdictions in the United States have adopted resolutions endorsing climate protection. Increasing regulation of greenhouse gas emissions is likely, given the multi-nation ratification of the Kyoto Protocol and California's adoption of AB 1439 addressing greenhouse gas emissions from transportation. Sonoma County and its nine cities are developing a greenhouse gas emissions inventory from government operations and will set targets for reducing the emissions, create an action plan for achieving those targets, implement the plan and monitor its progress. Sonoma County and Santa Rosa have each completed their emission inventories, and within the next six months the remaining eight cities are expected to complete theirs. The Sonoma County Waste Management Agency (SCWMA) provides administration for the project because all the cities and the county are represented on it. To support the program, Sonoma County has contributed \$25,000 and Santa Rosa has provided \$10,000. The other eight cities are each expected to contribute \$4,000.

The SCCPC believes that District technical expertise, public outreach and relations programs and its regional focus combine to create an ideal context for the coordination of regional climate protection efforts. It is therefore seeking \$25,000 from the District as well as its participation in the project. The District in turn will obtain data on how climate protection plans interface with attainment plans. Scientific data indicates that while criteria pollutants have been reduced over the years CO₂ levels continue to increase. Some of the funding from the District will also be used to leverage other funding for this project in Sonoma County. At the end of nine months, the SCCPC will provide a written report on these issues as well as make a presentation to the Board of Directors, and if requested, to the Advisory Council as well.

In discussion, Council members made the following suggestions to the SCCPC representatives:

- Re-approach the Northern Sonoma County Air Quality Management District for additional funds for this project. That District lead California in woodsmoke abatement, and much of the Bay Area's woodsmoke abatement action followed its initiative. (Altshuler)

- Precisely delineate the scope of emission inventory work conducted by the California Climate Action Registry and the SCCPC and consider how to coordinate their efforts. (Hayes)
- Set aside part of the \$25,000 to evaluate the methodology used to collect the data and to replicate it in other local jurisdictions. This goes beyond the SCCPC efforts to get the resolution passed elsewhere, and of ICLEI to replicate methodology for data gathering, and includes replicating and tracking the SCCPC program in other local jurisdictions. (Weiner).
- Precisely identify in what other ways the District may participate, such as in providing technical assistance in evaluating the link between the pollutants it regulates and greenhouse gas emissions, and in coordinating with outreach programs in other jurisdictions. (Blake)
- More clearly link the climate protection purpose of the SCCPC with the District's mission to protect public health through attainment of ambient air quality standards. Consider areas of SCCPC program linkage with new state regulation of fuel economy. Address impacts of warmer temperature on air quality from increased gasoline evaporation from vehicles, increased vapor emissions from stationary sources and increased electricity demand. Such linkages would more clearly place the SCCPC within the District's purview. (Harley)

Ms. Kelly opined that District involvement in the field of greenhouse gas emissions is appropriate since it is likely to receive regulatory responsibility for climate protection. Dr. Sawyer added that District staff support should also be provided to assist in ascertaining the nexus between greenhouse gas emissions and ozone photochemistry. Mr. Dawid observed that given the link between air quality and climate change, clean diesel might compare favorably with CNG. Mr. Altshuler replied it is important to consider the role of elemental carbon in effecting global climate change and added that there is considerable debate on the preferred fuel for buses (diesel, CNG, biodiesel, LNG) all of which have implications for emissions of CO₂.

Mr. Norton stated the Board would like to receive by the Council's next Regular Meeting its recommendation on whether the District should support this program. Mr. Kurucz stated the Council should first know more about the status of the District's budget in light of the state budget crisis before adopting a position. Chairperson Hanna responded that the Advisory Council's role is to advise the Board as to the worthiness of this proposed project. The Board of Directors and the District staff are best positioned to evaluate its fiscal impacts.

Mr. Hayes moved that the Council indicate it has heard the report of the SCCPC and supports in concept the regional approach this proposal represents to greenhouse gas management; that it plans to take it under further consideration and refer it to the Air Quality Planning and Technical Committees; and that it will adopt recommendations at its next Regular Meeting on March 12, 2003; seconded by Dr. Holtzclaw; carried unanimously by acclamation.